PATENTTI- JA REKISTERIHALLITUS
NATIONAL BOARD OF PATENTS AND REGISTRATION

PCT/FI 00/00428

Helsinki 20.6.2000

FI00/00428

E T U O I K E U S T O D I S T U S
P R I O R I T Y D O C U M E N T

4

Hakija
Applicant

Nokia Telecommunications Oy
Helsinki

Patenttihakemus nro
Patent application no

991093

Tekemispäivä
Filing date

12.05.1999

Kansainvälinen luokka
International class

H04L

Keksinnön nimitys
Title of invention

"Connection management method"
(Yhteyksien hallintamenetelmä)

Hakijan nimi on hakemusdiaariin **12.12.1999** tehdyn nimenmuutoksen jälkeen **Nokia Networks Oy**.

The application has according to an entry made in the register of patent applications on **12.12.1999** with the name changed into **Nokia Networks Oy**.

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

Kristiina Laulaanen
TARKASTAJA

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Maksu 300,- mk
Fee 300,- FIM

Osoite: Arkadiankatu 6 A
P.O.Box 1160
FIN-00101 Helsinki, FINLAND
Puhelin: 09 6939 500
Telephone: + 358 9 6939 500
Telefax: 09 6939 5328
Telefax: + 358 9 6939 5328

Connection management method

Technical field of the invention

The invention is concerned generally with packet data transmission in cellular telecommunication system, and more particularly with handling of speech connections transmitted using packet data transmission. Specifically, the invention is directed to a method according to the preamble of claim 1.

Background of the invention

A. The GPRS system

The GPRS (General Packet Radio Service) system is intended for transmission of data using packet switched connections. The GPRS system is designed to be added to existing GSM networks. It will also be used in the UMTS (Universal Mobile Telecommunication System). The packet data services provided by the GPRS system are ideal for non-real-time services, such as for example e-mail or file transfer services. In the following, the structure of a GPRS system is described with reference to figure 1.

The GPRS system introduces two new network elements as compared to the GSM framework, i.e. two types of GPRS Support Nodes (GSN) 50, 60: the Serving GPRS Support Node (SGSN) 50 and the Gateway GPRS Support Node (GGSN) 60. The SGSN 50 is at the same hierarchical level as the MSC (Mobile Services Switching Center) 40. The main task of a SGSN is to serve mobile stations 10, i.e. to keep track of the location of mobile stations, transmit data to the mobile stations, and to perform security functions and access control. The SGSN is connected to the base station subsystem 20, 30. A Gateway GSN (GGSN) 60 connects a GPRS network to external networks, such as the Internet 90 or a X.25 network 80. The SGSN and GGSN functionalities may be combined in the same physical device, or they may be realized in different physical devices. Further, GPRS subscriber information is stored in home location registers (HLR) 45. The GSN nodes are interconnected using an IP protocol based packet data network 70.

When data packets intended for a mobile station arrive from an external network 80,90, they are first received by a GGSN 60, which routes the packets to the serving GSN 50 of the mobile station 10. If the GGSN 60 does have information about the SGSN of the MS, the GGSN can request location information of the MS from the HLR 45. The SGSN forwards the packets to the MS 10 via the base station subsystem 20,30.

Three different classes of mobile stations will be supported. A class-A mobile station can simultaneously use both GPRS and circuit-switched services simultaneously. A class-B mobile station monitors control channels for GPRS and other network services simultaneously, but can use only one type of service at one time, i.e. either packet connections or circuit switched connections. A class-C mobile station can only use GPRS services.

In the GPRS system, a PDP (Packet Data Protocol) context is set up, before a mobile station can transmit or receive information. A PDP context is associated with the service provided by the GPRS system for a PDP address associated with a mobile station. A PDP address is an address for the MS according to the addressing scheme of an external network, to which the MS wishes to communicate. Further, a PDP context comprises entities in the MS, SGSN, and GGSN which control traffic associated with the PDP address. A PDP context comprises also further parameters such as the negotiated quality of service (QoS) and other configuration parameters. Zero, one or more static i.e. permanent PDP addresses may be defined for a mobile station. Dynamic PDP addresses may also be defined for a mobile station. A dynamic PDP address is valid only for the particular connection, for which a dynamic address is defined.

The GPRS system is described in more detail in the specification GSM 03.60.

B. The H.323 specification

Packet based networks are increasingly used for audio and video transmission as well. The H.323 specification has been created by the International Telecommunications Union (ITU) for the purpose of defining a standard framework for audio, video and data communications over networks that do not provide a guaranteed quality of service (QoS). Examples of such networks are IP-based

networks, such as corporate local area networks and the Internet. The aim of the H.323 specification is to allow multimedia products and applications from different manufacturers to interoperate. The H.323 specification defines functionality for call control, multimedia management, and bandwidth management as well as interfacing between networks. The H.323 specification defines four major types of network elements: terminals, gateways (GW), gatekeepers (GK), and multipoint control units (MCU). These will be shortly described in the following with reference to figure 1

A terminal 120,130 is a client device on the network, which typically provides real-time, two-way communication for the user. All H.323 terminals must support voice communications, and they also may support video and data communications. The H.323 specification specifies various modes of operation required for different terminals to communicate together. A terminal can be realized using a personal computer 130, or the terminal may be a stand alone unit such as a telephone 120. Further examples of terminals are Internet telephones, audio conferencing terminals, and video conferencing terminals.

A gateway 100 is used to connect a H.323 network to other types of networks and/or terminal types. A gateway may for example translate transmission formats or protocols between the networks. A gateway can also participate in call setup procedures between the networks.

A gatekeeper 110 functions as a controlling unit for a given section of a H.323 network, i.e. a H.323 zone. A gatekeeper provides call control services to registered endpoints i.e. terminals. Further, a gatekeeper performs address translation between local area network aliases for terminals and gateways to IP addresses. A gatekeeper may also perform bandwidth management, i.e. transmission resource control. The gatekeeper can also be used to route H.323 calls, in which case the calls are under control of the gatekeeper, which allows a simple way of providing many different kinds of services and traffic management features. While the concept of a gatekeeper is logically separate from the concept of a gateway or a multipoint control unit (MCU), the gatekeeper can be realized in the same physical device as a gateway or a MCU.

A Multipoint Control Unit (MCU) 140 is a unit, which manages conference calls, i.e. connections having at least three participants. A multipoint control unit comprises a multipoint controller (MC), and it may also comprise multipoint processors (MP). A MC handles connection management negotiations between the participants. Multipoint processors take care of the actual processing of the data streams, i.e. performs mixing, switching, and any other processing of the audio, video, and/or data streams. Functionality of a MCU can be implemented in a dedicated network element, or the functionality can be realized in another H.323 component.

C. Some problems of the prior art

Since the GPRS system is a system which provides packet data transmission, speech and video connections according to the H.323 specification can be established through the GPRS system. However, the GPRS system is optimized for data transmission, not for real-time services such as speech or video transmission. Therefore performing voice transmission over a GPRS network for example according to H.323 protocols introduces problems. Voice transmission over the GPRS system occurs for example when the user of a H.323 voice terminal 120 wishes to call the mobile station 10, in which case the data packets of the speech signal are transmitted through the H.323 network 150, the Internet 90, and the GPRS system 60,70,50,30,20. One specific problem is how the GPRS system can identify, which packet data connection is a real time connection requiring a high connection quality, and which connections are normal data connections. If the GPRS system is unable to correctly identify real time connections such as voice or video connections and provide a corresponding level of service instead of normal service awarded for data connections, the users will be disturbed by any eventual delays, which are acceptable and normal in data connections.

Summary of the invention

An object of the invention is to provide a method for management of real time connections in a GPRS network. A further object of the invention is to provide a system, which is able to identify real time connections.

The objects are reached by arranging the GPRS system to monitor a transport layer service access point (TSAP) such as a specific UDP (User Datagram Protocol) port, which is used for IP telephony call setup and release signaling.

The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a system. The network element according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a network element. The mobile station according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a mobile station. The dependent claims describe further advantageous embodiments of the invention.

According to the invention, the GPRS system is arranged to monitor IP telephony call setup messages, which can be performed by monitoring a transport layer service access point (TSAP), which the IP telephony system uses for call setup signaling. Such a TSAP may be for example a specific UDP (User Datagram Protocol) or TCP (Transmission Control Protocol) port at the IP address corresponding to the mobile station. The term TSAP identifier is used to refer to the particular port number or a corresponding identifier of a TSAP. The monitoring may be performed for example by the GPRS control entities in the mobile station, whereby the control entities are able to determine if the packet connection requires more transmission capacity due to the use of the connection for a real time service such as speech or video. Thereafter the control entities are able to set up a PDP context having a corresponding level of service. Monitoring in the mobile station is advantageous in mobile originated IP telephony calls. The monitoring may as well be performed by a GSN, which is advantageous for mobile terminated IP telephony connections.

The invention can be used with any IP telephony protocol, such as the H.323 protocol and the SIP protocol. In the following description several examples are presented within the context of H.323 protocol. However, the invention is not limited to be used in connection with H.323 protocol only, since other IP telephony protocols such as the SIP protocol may as well be used.

Brief description of the drawings

The invention is described in more detail in the following with reference to the accompanying drawings, of which

figure 1 shows a GPRS system and a H.323 zone interconnected through the Internet according to prior art,

figure 2 illustrates a signaling sequence according to an advantageous embodiment of the invention,

figure 3 illustrates a second example of a signaling sequence according to a further advantageous embodiment of the invention,

figure 4 illustrates a third example of a signaling sequence according to an advantageous embodiment of the invention,

figure 5 illustrates a fourth example of a signaling sequence according to an advantageous embodiment of the invention,

figure 6 illustrates a flow chart of method according to an advantageous embodiment of the invention, and

figure 7 illustrates an example of a system according to an advantageous embodiment of the invention.

Same reference numerals are used for similar entities in the figures.

Detailed description

1. A first advantageous embodiment of the invention

In an advantageous embodiment of the invention, a well-known transport layer service access point (TSAP) identifier is used. A well-known TSAP identifier according to the H.323 specification is a TSAP identifier that has been allocated by an authority that is in charge of the assignment of TSAP identifiers for a particular networking protocol and the related transport protocols. For example, the port 1720 has been allocated for use as a TSAP in the UDP protocol. This means, that when the UDP protocol is used as the transport protocol in H.323 connections, connection setup messages to a network element or a terminal are directed to the UDP port 1720 at the IP address of the network element or the terminal.

In this embodiment of the invention, the GPRS system can monitor the UDP port number 1720. Any observed H.323 call setup signals at the port consequently

signify, that the corresponding call is a H.323 call, whereby the necessary capacity for the service can be reserved, for example by creating a corresponding PDP context.

In the case that the originating terminal of the H.323 call is a GPRS mobile station, the unit performing the monitoring is the mobile station, more accurately a GPRS entity of the mobile station. When the GPRS entity observes H.323 call setup signaling messages directed to the UDP port 1720 at the destination, it then requests the network to activate a PDP context according to the requirements of the call.

In the case that a GPRS terminal is the receiving terminal of a H.323 call, a network element such as a SGSN or a GGSN can monitor any arriving messages addressed to UDP port 1720 of the receiving terminal, and activate the setting up of a corresponding PDP context for the receiving terminal.

2. A second advantageous embodiment of the invention

According to the H.323 specification, a terminal may use a dynamically allocated port for call setup signaling. In such a case, the originating terminal requests a port identifier from the gatekeeper of its zone. The gatekeeper returns a port identifier identifying the port to be used at the receiving terminal, which port identifier the originating terminal consequently uses for call setup signaling.

In an advantageous embodiment of the invention, a dynamically assigned TSAP is used for call setup signaling. Such an embodiment is feasible, when the gatekeeper functionality is integrated in a GPRS network element, such as a SGSN. In such an embodiment, the gatekeeper may set up the necessary PDP contexts as a response to receiving a request for a dynamic TSAP identifier from a mobile station.

In a further advantageous embodiment of the invention, the GSN functioning as the gatekeeper begins monitoring call setup messages addressed to the assigned TSAP, after the SGSN has allocated a TSAP identifier and communicated the allocated identifier to the mobile station which has requested a TSAP identifier to be allocated. When the SGSN observes call setup messages, it can set up corresponding PDP contexts for the call.

3. An example of a signaling sequence

Figure 2 illustrates a signaling sequence according to an advantageous embodiment of the invention. Figure 2 illustrates signaling between a H.323 entity 10A in the mobile station 10, a GPRS entity 10B in the mobile station 10, a SGSN 50, a GGSN 60, and a remote H.323 terminal 120. The H.323 entity 10A in the mobile station 10 may be for example a speech conferencing program, which can create and use H.323 connections.

Signaling according to figure 2 may occur for example when the MS is in the idle state, or for example when the H.323 call will be activated using a PDP address corresponding to an inactive PDP context, i.e. another PDP context than that or those already active.

In this example, the GPRS entity 10B of the MS performs the monitoring for H.323 call setup signaling.

In the first step 205, the H.323 entity 10A in the mobile station 10 starts call setup signaling according to the H.323 protocol, and sends a PDU (protocol data unit) containing a call setup message. The PDU is first received by the GPRS entity 10B in the mobile station 10. The GPRS entity 10B observes, that the PDU is addressed to a TSAP in the external packet network, such as the UDP port 1720 at a an address of the external network, and that the PDU contains a H.323 call setup message. The GPRS entity 10B can determine the characteristics of the H.323 call from the setup message, and start a PDP context activation sequence with corresponding parameters.

The PDP context activation sequence proceeds according to the GSM 03.60 specification as described in steps 210 to 230. The MS 10 sends 210 an ACTIVATE PDP CONTEXT REQUEST message to the SGSN, listing the desired context parameters as parameters of the message. In the next step 215, the MS and the SGSN may optionally exchange messages relating to security functions. In the next step 220, the SGSN sends a CREATE PDP CONTEXT REQUEST message to the GGSN connecting the GPRS system to the external network. The GGSN responds by sending 225 a CREATE PDP CONTEXT RESPONSE message back to the SGSN. In the next step, the SGSN finishes the PDP context sequence by sending

230 an ACTIVATE PDP CONTEXT ACCEPT message to the MS, listing the parameters of the PDP context as parameters of the message. The PDP context activation sequence of steps 210 to 230 is described in further detail in section 9.2.2.1 of the GSM 03.60 specification version 6.2.0.

After receiving the ACCEPT message, the GPRS entity 10B of the MS can send 235 the PDU of the H.323 application to the remote H.323 terminal via the SGSN and GGSN. Thereafter, the H.323 entity 10A of the MS and the remote H.323 terminal 120 can continue normally call setup signaling and call data transfer.

4. Another example of a signaling sequence

Figure 3 illustrates a signaling sequence according to a further advantageous embodiment of the invention. Figure 3 illustrates signaling between a H.323 entity 10A in the mobile station 10, a GPRS entity 10B in the mobile station 10, a SGSN 50, a GGSN 60, and a remote H.323 terminal 120. The H.323 entity 10A in the mobile station 10 may be for example a speech conferencing program, which can create and use H.323 connections.

Signaling according to figure 3 may occur for example when the MS already has an active PDP context, and the PDP address of the active PDP context will be used for a H.323 call.

In this example, the SGSN performs the monitoring of H.323 call setup signaling.

In the first step 305, the H.323 entity 10A in the mobile station 10 starts call setup signaling according to the H.323 protocol, and sends a PDU (protocol data unit) containing a call setup message. The PDU is first received by the GPRS entity 10B in the mobile station 10, which forwards 310 the PDU to the SGSN. The SGSN 50 observes, that the PDU is addressed to a TSAP in the external packet network, such as the UDP port 1720 at a an address of the external network, and that the PDU contains a H.323 call setup message. The SGSN 50 can determine the characteristics of the H.323 call from the setup message, and start a PDP context modification sequence to modify the active PDP context accordingly.

The PDP context modification sequence proceeds according to the GSM 03.60 specification as described in steps 315 to 330. In the next step 315, the SGSN 50 sends an UPDATE PDP CONTEXT REQUEST to the GGSN 60, to which the GGSN replies by sending 320 an UPDATE PDP CONTEXT RESPONSE message back to SGSN. Steps 315 and 320 are optional according to the GSM 03.60 specification and do not need to be always performed. Next, the SGSN sends 325 a MODIFY PDP CONTEXT REQUEST message to the MS listing the new parameters of the PDP context as parameters of the message. The MS responds by sending 330 a MODIFY PDP CONTEXT ACCEPT message back to the SGSN. The PDP context modification sequence of steps 315 to 330 is described in further detail in section 9.2.3.1 of the GSM 03.60 specification version 6.2.0.

After the PDP context modification sequence is completed, the SGSN continues to send 335 further the PDU's from the MS via the GGSN to the remote H.323 terminal in the normal way.

In a further advantageous embodiment, the GPRS entity 10B of the MS performs the monitoring of data packets, and if a call setup message is detected, the GPRS entity 10B sends a message to the SGSN. Preferably, the GPRS entity 10B attaches parameters from the call setup message as a parameter to the message it sends to the SGSN. After receiving the message, the SGSN can execute the PDP context modification sequence as described previously in steps 315 to 330, whereafter the MS can continue transmitting PDU's as before.

5. A third example of a signaling sequence

Figure 4 illustrates a signaling sequence according to a further advantageous embodiment of the invention. Figure 4 illustrates signaling between a H.323 entity 10A in the mobile station 10, a GPRS entity 10B in the mobile station 10, a SGSN 50, a GGSN 60, and a remote H.323 terminal 120. The H.323 entity 10A in the mobile station 10 may be for example a speech conferencing program, which can create and use H.323 connections.

Signaling according to figure 4 may occur for example when a remote H.323 terminal sends call setup messages to a MS, and the PDP context for the corresponding PDP address of the MS is inactive.

In this example, the GGSN performs the monitoring of H.323 call setup signaling.

First, a remote H.323 terminal 120 sends 405 a call setup message in a PDU (protocol data unit) addressed to a TSAP at the PDP address of the MS. After receiving the PDU, the GGSN examines 406 the PDU and observes, that it is addressed to a TSAP and contains a call setup message. Next, the GGSN extracts 408 information from the call setup message concerning the nature of the call, for example information about the necessary quality of service level. If the GGSN does not have any information about the location of the addressed MS, i.e. does not know which GSN is the serving GSN for the MS, the GGSN can at this stage request routing information from the HLR. For clarity, signaling between HLR and GGSN is not illustrated in figure 4. In the next step 410, the GGSN sends 410 a PDU NOTIFICATION REQUEST message to the SGSN. Preferably, the GGSN attaches the previously extracted information as a parameter to the message to inform the SGSN about the necessary level of service for the call. The SGSN responds by sending 415 a PDU NOTIFICATION RESPONSE message to the GGSN. After sending the message, the SGSN sends 420 a REQUEST PDP CONTEXT ACTIVATION message to the MS, which triggers a normal PDP context activation sequence as described in the following in steps 210 to 230.

The PDP context activation sequence proceeds according to the GSM 03.60 specification as described in steps 210 to 230. The MS 10 sends 210 an ACTIVATE PDP CONTEXT REQUEST message to the SGSN, listing the desired context parameters as parameters of the message. In the next step 215, the MS and the SGSN may optionally exchange messages relating to security functions. In the next step 220, the SGSN sends a CREATE PDP CONTEXT REQUEST message to the GGSN connecting the GPRS system to the external network. The GGSN responds by sending 225 a CREATE PDP CONTEXT RESPONSE message back to the SGSN. In the next step, the SGSN finishes the PDP context sequence by sending 230 an ACTIVATE PDP CONTEXT ACCEPT message to the MS, listing the parameters of the PDP context as parameters of the message. The PDP context activation sequence of steps 210 to 230 is described in further detail in section 9.2.2.1 of the GSM 03.60 specification version 6.2.0.

After the PDP context activation sequence is completed, the GGSN sends 425 the PDU received from the remote terminal to the SGSN, which forwards 430 it to the GPRS entity 10B of the MS, whereafter the PDU is given 435 to the H.323 entity 10A of the MS.

In another advantageous embodiment, the SGSN performs the monitoring. In this embodiment, the activation of a PDP context after the GPRS system receives a PDU from a remote H.323 terminal is performed according to prior art, for example as described in section 9.2.2.2.1 of the GSM 03.60 specification version 6.2.0. After the PDP context is activated, the data packets start flowing via the SGSN. When the SGSN detects a call setup message in a data packet, the SGSN starts a PDP context modification procedure as described previously with reference to steps 315 to 330 of figure 3, or for example as described in section 9.2.3.1 of the GSM 03.60 specification version 6.2.0. This embodiment has the advantage, that the inventive functionality can be implemented completely in the SGSN, whereby no new signaling messages need to be defined.

6. A fourth example of a signaling sequence

Figure 5 illustrates a signaling sequence according to a further advantageous embodiment of the invention. Figure 5 illustrates signaling between a H.323 entity 10A in the mobile station 10, a GPRS entity 10B in the mobile station 10, a SGSN 50, a GGSN 60, and a remote H.323 terminal 120. The H.323 entity 10A in the mobile station 10 may be for example a speech conferencing program, which can create and use H.323 connections.

Signaling according to figure 5 may occur for example when a remote H.323 terminal sends call setup messages to a MS, and the PDP context for the corresponding PDP address of the MS is already active.

In this example, the SGSN performs the monitoring of H.323 call setup signaling.

First, a remote H.323 terminal 120 sends 505 a call setup message in a PDU (protocol data unit) addressed to a TSAP at the PDP address of the MS. The GGSN forwards 510 the PDU to the SGSN. After receiving the PDU, the SGSN examines 511 the PDU and observes, that it is addressed to a TSAP and contains a call setup

message. Next, the SGSN extracts 512 information from the call setup message concerning the nature of the call, for example information about the necessary quality of service level. If the service level is not good enough for the call, the SGSN may initiate a PDP context modification sequence, which is the case described in figure 5. The modification sequence comprises steps 315 to 330, which are described in the following.

The PDP context modification sequence proceeds according to the GSM 03.60 specification as described in steps 315 to 330. In the next step 315, the SGSN 50 sends an UPDATE PDP CONTEXT REQUEST to the GGSN 60, to which the GGSN replies by sending 320 an UPDATE PDP CONTEXT RESPONSE message back to SGSN. Steps 315 and 320 are optional according to the GSM 03.60 specification and do not need to be always performed. Next, the SGSN sends 325 a MODIFY PDP CONTEXT REQUEST message to the MS listing the new parameters of the PDP context as parameters of the message. The MS responds by sending 330 a MODIFY PDP CONTEXT ACCEPT message back to the SGSN. The PDP context modification sequence of steps 315 to 330 is described in further detail in section 9.2.3.1 of the GSM 03.60 specification version 6.2.0.

After the PDP context modification sequence is completed, the SGSN sends 515 the PDU containing the call setup message to the GPRS entity 10B of the MS, whereafter the PDU is given 520 to the H.323 entity 10A of the MS.

7. An example of a method

In the following, a method according to an advantageous embodiment of the invention is described with reference to figure 6. In this method, data packets transmitted by the GPRS system are monitored in step 605 for detecting packets comprising connection setup messages. If such a data packet has not been detected in step 610, monitoring is continued at step 605. If a packet comprising a connection setup message is detected, information contained in the connection setup message is extracted from the message in step 615, and used in determining 620 at least one parameter of a PDP context. The monitoring may preferably be performed by a serving GPRS support node, a gateway GPRS support node, or for example a GPRS mobile station. The parameter may for example be the maximum allowed delay, priority, or amount of transmission resources reserved for the PDP context.

Preferably, said connection setup messages being monitored are H.323 connection setup messages.

In the next step 625, it is checked if a PDP context for the connection is already active. If said PDP context is not active when the packet is detected, said PDP context is set up 630 at least in part according to said at least one parameter. If said PDP context is active when the packet is detected, said PDP context is modified 635 at least in part according to said at least one parameter.

8. An example of a system

Figure 7 illustrates an example of a system according to an advantageous embodiment of the invention. Figure 7 shows a part of a GPRS system, namely a GGSN 60 connected to an external network 80,90 such as an X.25 network or the Internet, a SGSN 50, and the internal IP network 70 of the GPRS system. Figure 7 further shows a home location register 45 connected to the GPRS network 70, a base station controller (BSC) 30, two base stations 20, and a mobile station 10.

A system 700 according to the invention comprises means 710 for monitoring data packets transmitted in the GPRS system, means 720 for detecting a call setup message in a data packet, and means 730 for determining at least one connection parameter based on information in a detected call setup message.

Advantageously, the system further comprises means 740 for initiating the setting up a PDP context at least partly based on said at least one connection parameter. Further, the system advantageously also comprises means 750 for initiating the modifying a PDP context at least partly based on said at least one connection parameter.

The system according to the invention may advantageously be implemented in a single network element 50,60 of a GPRS system. The network element may advantageously be a serving GPRS support node. Further, the system may also be implemented in a gateway GPRS support node.

However, the invention is not limited to the system being in a single element, since the various means for realizing the functionality of the system may also be realized in more than one separate network elements.

According to one advantageous embodiment, a mobile station 10 comprises means 710 for monitoring data packets, means 720 for detecting a call setup message in a data packet, and means 730 for determining at least one connection parameter based on information in a detected call setup message.

Preferably the means 710,720,730,740,750 are realized using software programs stored in a memory element of a control unit of a network element or a mobile communication means, the programs being executed by a microprocessor of the control unit.

9. Connection state change signaling

The previous examples teach the use of the invention in connection with call setup signaling. However, the invention can also be used in connection with other types of call state change signaling such as call release signaling. In such an embodiment of the invention, if call release signaling is observed, a corresponding PDP context modification or release procedure is started.

In one example of such an embodiment of the invention, the GPRS system can for example monitor the UDP port number 1720. Any observed H.323 call release signals at the port consequently signify, that the resources for the corresponding call can be released for example by releasing the corresponding PDP context.

In a further advantageous embodiment of the invention, connection status signaling such as signaling associated with changing of parameters of the connections is monitored. For example, if the data transfer rate of a H.323 connection is changed during the connection, the GPRS system observes the associated signaling, interprets the signaling for obtaining an estimate of how much resources will be needed after the change, and changes at least one parameter of the corresponding PDP context accordingly.

In the following claims, the term connection status change message refers to call setup messages, call release messages, and messages which aim to change a property of the associated call.

The entity performing the monitoring for connection status change signaling such as call release signaling can advantageously be the SGSN associated with the call.

10. Further considerations

Although in the previous description, the inventive method has been explained using examples from the GPRS system, the invention is not limited to being used in the GPRS system, since the invention can also be used in other packet data radio systems, such as systems developed from a second generation GPRS system.

As described previously, the invention can be used with any IP telephony protocol, such as the H.323 protocol and the SIP protocol. In the previous description several examples are presented within the context of H.323 protocol. However, the invention is not limited to be used in connection with H.323 protocol only, since other IP telephony protocols such as the SIP protocol may as well be used.

The name of a given functional entity, such as the base station controller, is often different in the context of different cellular telecommunication systems. For example, in the UMTS system the functional entity corresponding to a base station controller (BSC) is the radio network controller (RNC). Therefore, the particular terminology used to denote various functional entities in this specification are only examples according to the GSM system, and do not limit the invention in any way. Further, the various command names recited in this specification are intended to be examples only, and the invention is not limited to using the command names recited in this specification.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. A method for managing connections in a packet data radio system, **characterized** in that data packets transmitted by the packet data radio system are monitored for detecting packets comprising connection state change messages, and if a packet comprising a connection state change message is detected, information contained in the connection state change message is used in determining at least one parameter of a packet data connection of the packet data radio system.

2. A method according to claim 1, **characterized** in that said connection state change messages being monitored are connection setup messages.

3. A method according to claim 1, **characterized** in that said connection state change messages being monitored are connection release messages.

4. A method according to claim 1, **characterized** in that said connection state change messages being monitored are H.323 connection state change messages.

5. A method according to claim 1, **characterized** in that said connection state change messages being monitored are connection state change messages according to the SIP protocol.

6. A method according to claim 1, **characterized** in that the packet data radio system is the GPRS system.

7. A method according to claim 1, **characterized** in that the method comprises steps, in which said packet data connection of the packet data radio system is set up at least in part according to said at least one parameter.

8. A method according to claim 1, **characterized** in that the method comprises steps, in which said packet data connection of the packet data radio system is modified at least in part according to said at least one parameter.

9. A method according to claim 6, **characterized** in that said monitoring is performed by a serving GPRS support node.

10. A method according to claim 6, **characterized** in that said monitoring is performed by a gateway GPRS support node.

11. A method according to claim 6, **characterized** in that said monitoring is performed by a GPRS mobile station.

12. A system for managing connections in a packet data radio system, **characterized** in that it comprises
means for monitoring data packets transmitted in the packet data radio system,
means for detecting a call setup message in a data packet, and
means for determining at least one connection parameter based on information in a detected call setup message.

13. A system according to claim 12, **characterized** in that the system further comprises means for initiating the setting up a packet data connection of the packet data radio system at least partly based on said at least one connection parameter.

14. A system according to claim 12, **characterized** in that the system further comprises means for initiating the modifying a packet data connection of the packet data radio system at least partly based on said at least one connection parameter.

15. A packet data radio system network element, **characterized** in that it comprises
means for monitoring data packets transmitted by the network element,
means for detecting a call setup message in a data packet, and
means for determining at least one connection parameter based on information in a detected call setup message.

16. A packet data radio system network element according to claim 15, **characterized** in that it is a GPRS network element.

17. A packet data radio system network element according to claim 16, **characterized** in that the network element is a serving GPRS support node.

18. A packet data radio system network element according to claim 16, **characterized** in that the network element is a gateway GPRS support node.

19. A mobile station, **characterized** in that it comprises
means for monitoring data packets,
means for detecting a call setup message in a data packet, and
means for determining at least one connection parameter based on information in a detected call setup message.

Abstract

The invention is concerned generally with packet data transmission in cellular telecommunication system, and more particularly with handling of speech connections transmitted using packet data transmission. According to the invention, the GPRS system is arranged to monitor IP telephony call state change messages, which can be performed by monitoring a transport layer service access point (TSAP), which the IP telephony system uses for call state change signaling. The invention can be used with any IP telephony protocol, such as the H.323 protocol and the SIP protocol. Such a TSAP may be for example a specific UDP (User Datagram Protocol) or TCP (Transmission Control Protocol) port at the IP address corresponding to the mobile station. The monitoring may be performed for example by the GPRS control entities in the mobile station, whereby they are able to determine if a new requested packet connection will be used for a H.323 speech or video connection and negotiate and set up a PDP context having a corresponding level of service. Monitoring in the mobile station is advantageous in mobile originated H.323 calls. The monitoring may as well be performed by a GSN, which is advantageous for mobile terminated H.323 connections.

Figure 3

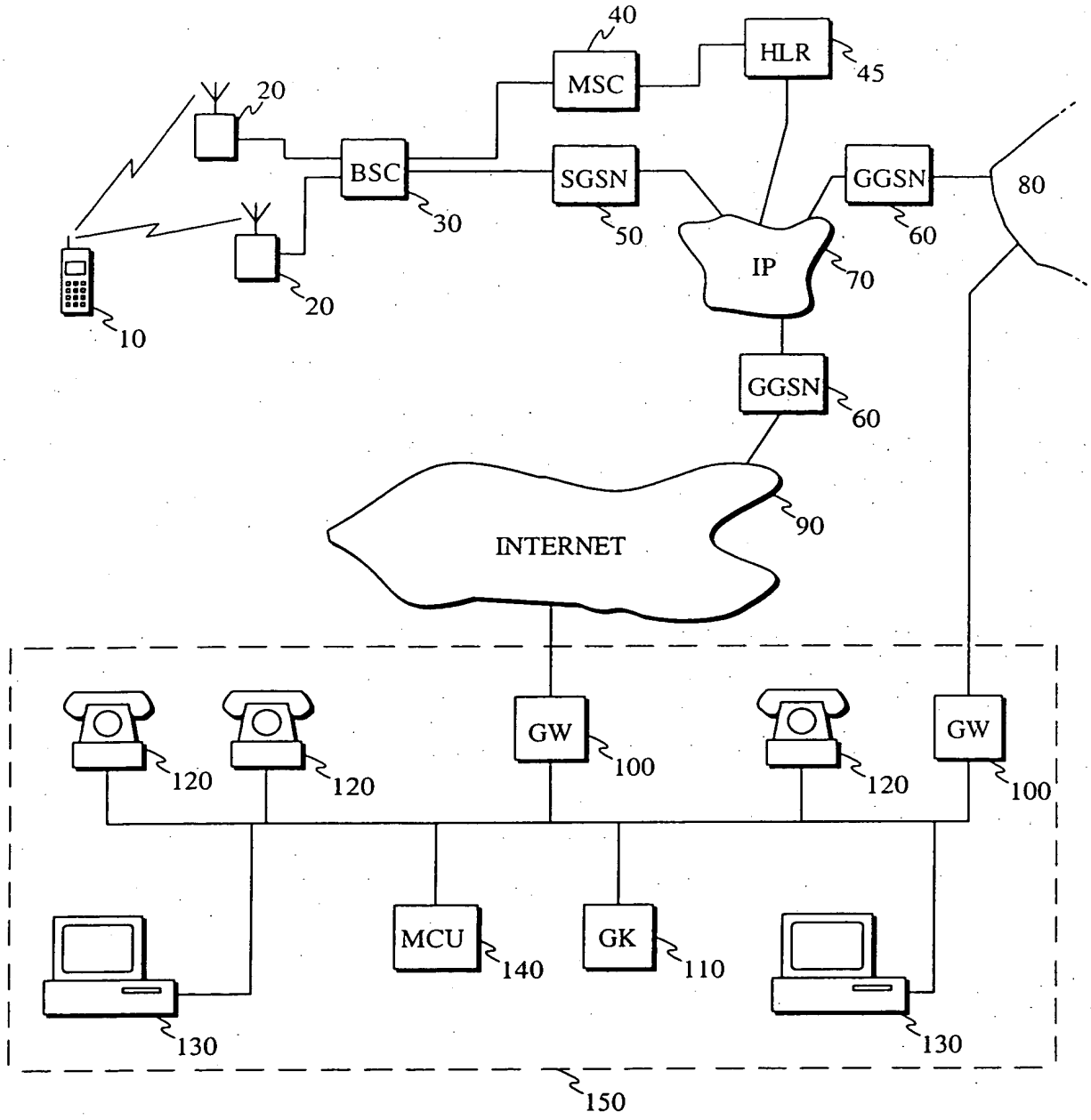

Fig. 1
PRIOR ART

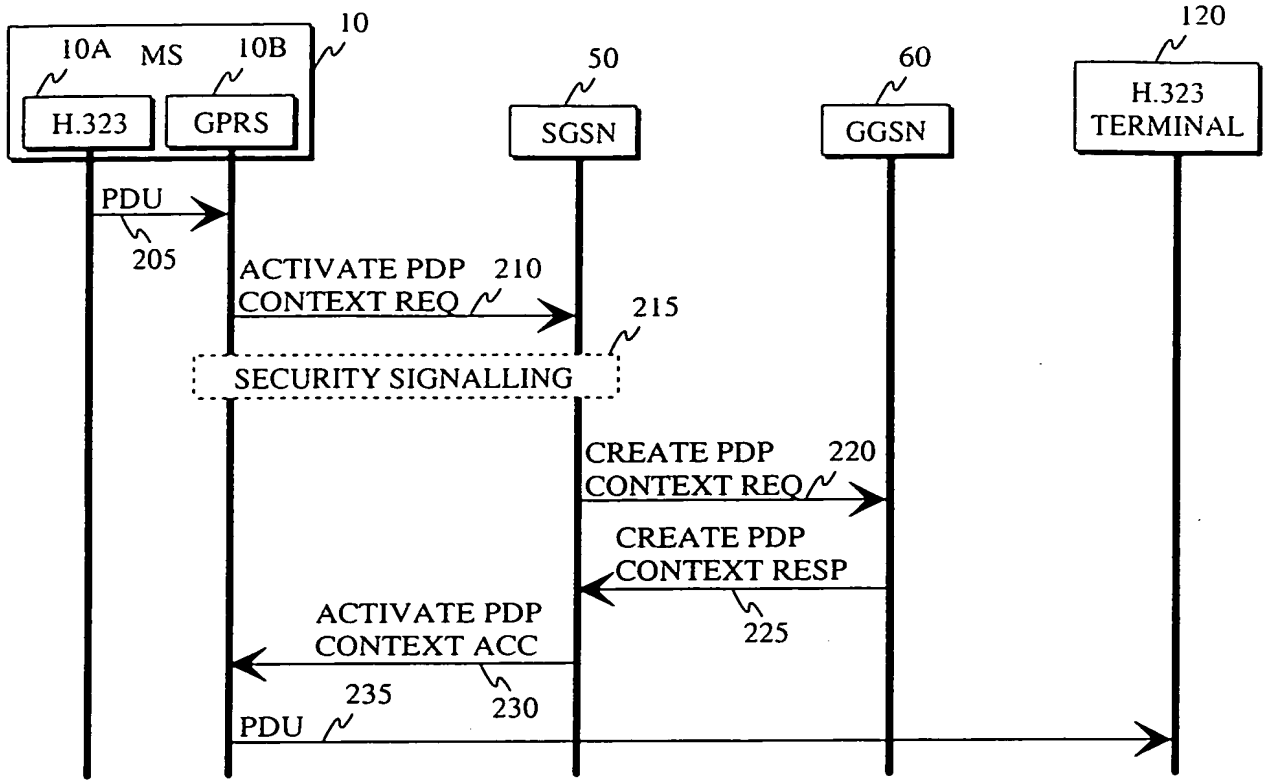
10
10A
MS
10B
H.323
GPRS
50
SGSN
60
GGSN
120
H.323
TERMINAL
PDU
205
ACTIVATE PDP
CONTEXT REQ
210
215
SECURITY SIGNALLING
CREATE PDP
CONTEXT REQ
220
CREATE PDP
CONTEXT RESP
225
ACTIVATE PDP
CONTEXT ACC
230
235
PDU

Fig. 2

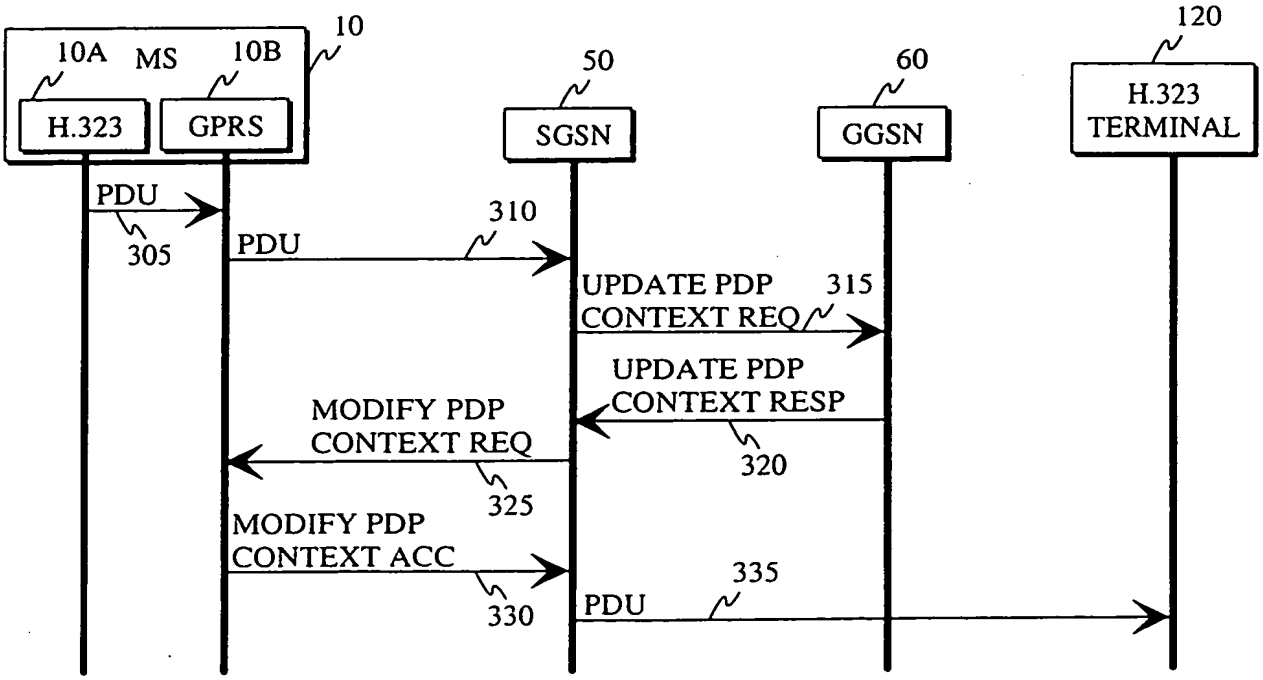
10
10A
MS
10B
H.323
GPRS
50
SGSN
60
GGSN
120
H.323
TERMINAL
PDU
305
PDU
310
UPDATE PDP
CONTEXT REQ
315
UPDATE PDP
CONTEXT RESP
320
MODIFY PDP
CONTEXT REQ
325
MODIFY PDP
CONTEXT ACC
330
335
PDU

Fig. 3

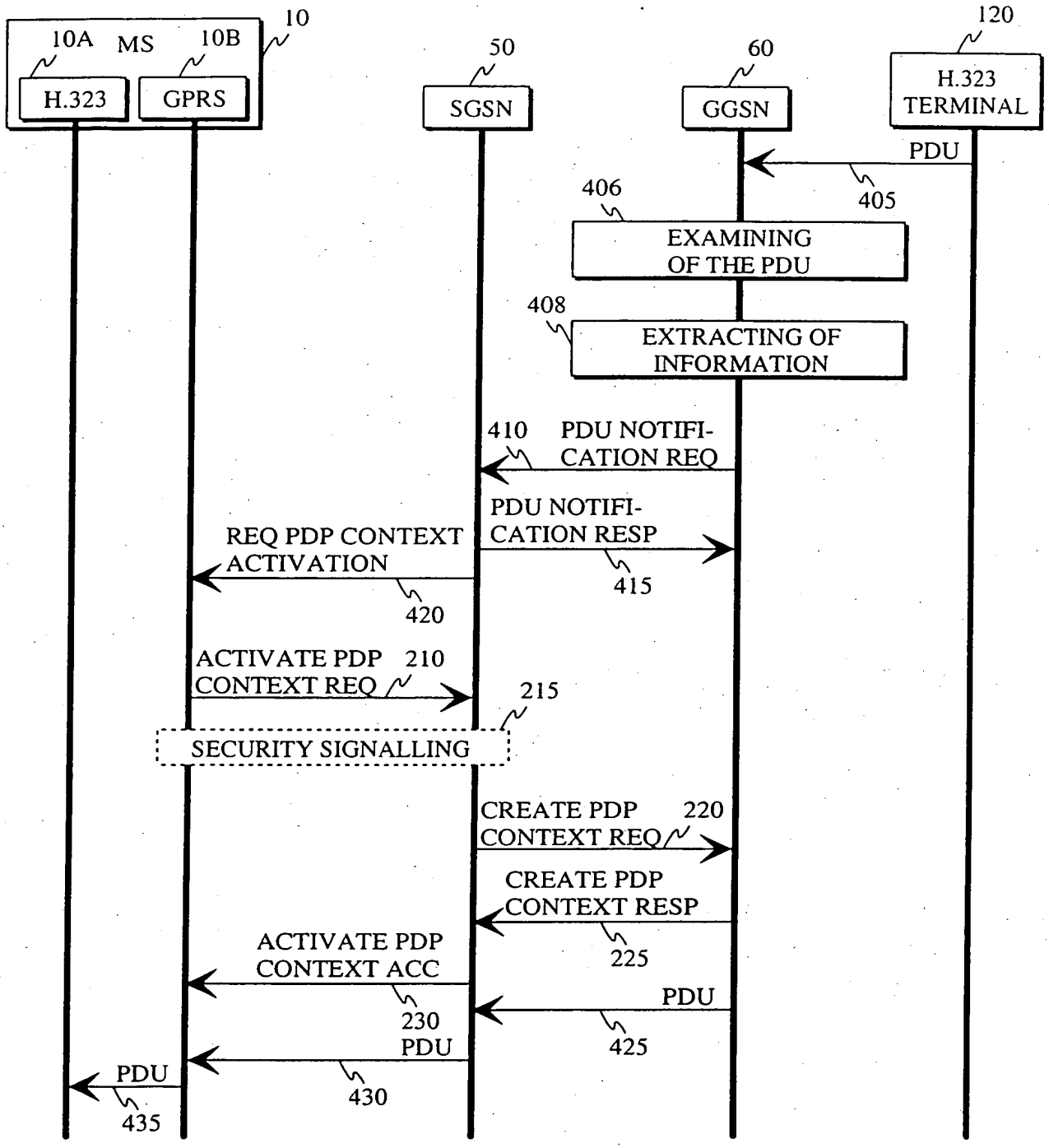
10
10A
MS
10B
H.323
GPRS
50
SGSN
60
GGSN
120
H.323
TERMINAL
PDU
405
406
EXAMINING
OF THE PDU
408
EXTRACTING OF
INFORMATION
410
PDU NOTIFI-
CATION REQ
PDU NOTIFI-
CATION RESP
415
REQ PDP CONTEXT
ACTIVATION
420
ACTIVATE PDP
CONTEXT REQ
210
215
SECURITY SIGNALLING
CREATE PDP
CONTEXT REQ
220
CREATE PDP
CONTEXT RESP
225
ACTIVATE PDP
CONTEXT ACC
230
PDU
425
PDU
430
PDU
435

Fig. 4

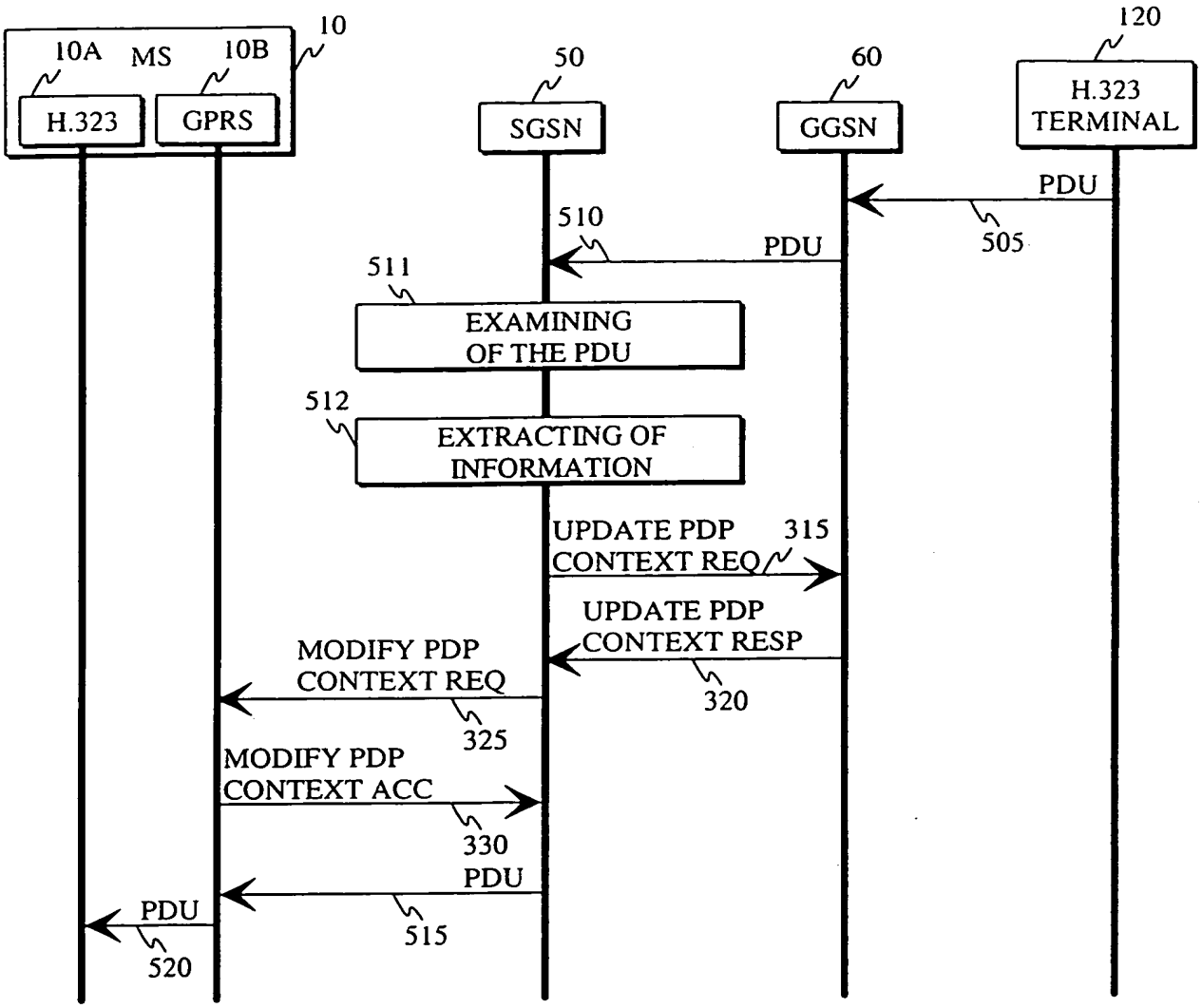
10
10A
MS
10B
H.323
GPRS
50
SGSN
60
GGSN
120
H.323
TERMINAL
PDU
505
510
PDU
511
EXAMINING
OF THE PDU
512
EXTRACTING OF
INFORMATION
UPDATE PDP
CONTEXT REQ
315
UPDATE PDP
CONTEXT RESP
320
MODIFY PDP
CONTEXT REQ
325
MODIFY PDP
CONTEXT ACC
330
PDU
515
PDU
520

Fig. 5

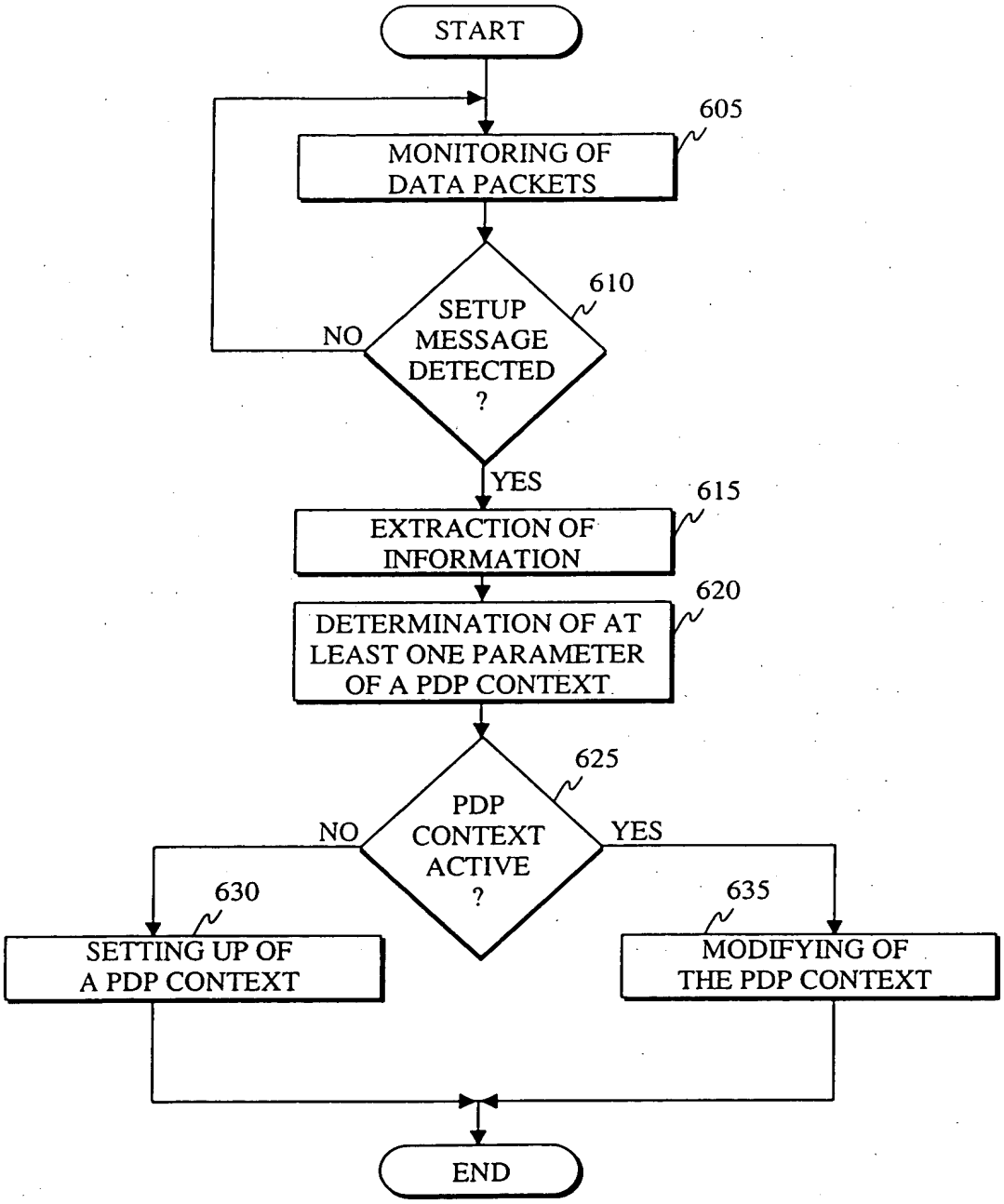
START
605
MONITORING OF DATA PACKETS
610
SETUP MESSAGE DETECTED ?
NO
YES
615
EXTRACTION OF INFORMATION
620
DETERMINATION OF AT LEAST ONE PARAMETER OF A PDP CONTEXT
625
PDP CONTEXT ACTIVE ?
NO
YES
630
SETTING UP OF A PDP CONTEXT
635
MODIFYING OF THE PDP CONTEXT
END

Fig. 6

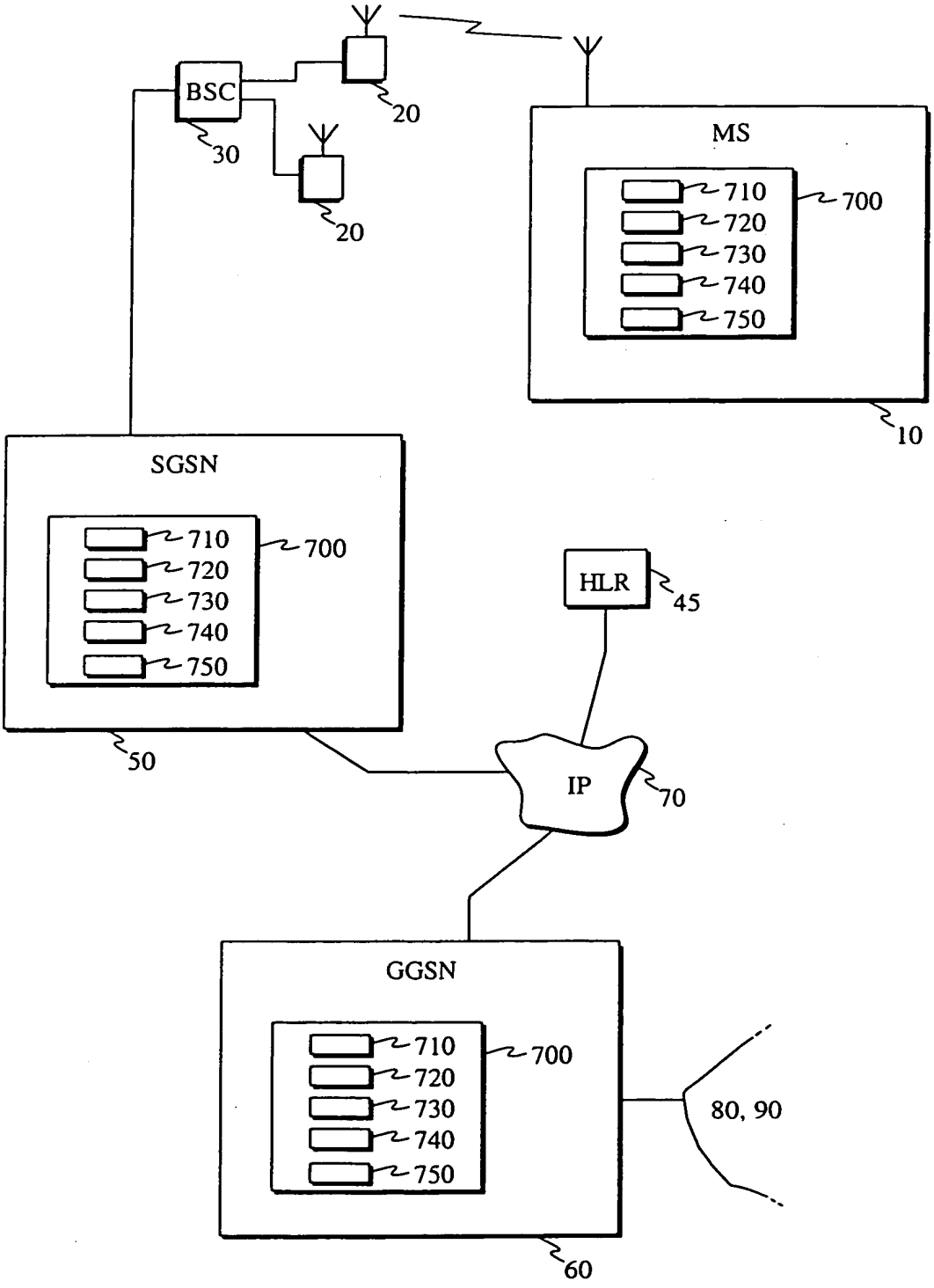
BSC
20
30
20
MS
710
720
730
740
750
700
10
SGSN
710
720
730
740
750
700
50
HLR
45
IP
70
GGSN
710
720
730
740
750
700
80, 90
60

Fig. 7